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Title of The Invention

VEHICLE DOOR

The invention relates to a vehicle door comprising a door structure, consisting of an outer wall and of lower and lateral walls and which is open towards the inside of the vehicle, an equipment support, which can be fixed to the door structure and which bears already fixed equipment such as the window glass, the mechanisms for driving and guiding its movement, and the like. The equipment support essentially supports equipment which is decisive in terms of weight and/or which exerts and/or transmits forces. The vehicle door also comprises an interior lining. The equipment support is arranged between the outer wall of the door and the interior lining.

DISCUSSION OF THE BACKGROUND

A modular-type construction for vehicle doors, whereby the equipment support is produced in the shape of a flat plate with fixings and openings, is known (DE-A-195 09 282). An interior trim lining may be fixed to the bearing plate, this lining having a shape that corresponds to the desired style.

The bearer plate and the trim lining are not stable enough to be handled as a module until they are assembled together.

However, after this pre-assembly, there is a risk that the trim lining might become damaged during installation in the door and that it might be necessary to replace it.

Such vehicle doors are also, for example, described in documents DE-A1-32 09 052 and DE-A1-323 17 640.

According to these embodiments, the equipment support is also a continuous support plate made of sheet metal or glass-fibre-reinforced polyester resin. To improve rigidity, the support plate has reinforcements, for example reinforcing ribs or, alternatively, reinforcing tubes are formed in the equipment support or slipped into corresponding passages in the equipment support. On the side facing

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towards the inside of the vehicle, the equipment support plate has an interior covering, preferably a layer of foam covered with fabric and/or flocked. The equipment support plate has moulded-in cavities and/or hollow spaces in which the equipment and/or bits of equipment are arranged and fixed to the support plate before the latter is screwed to the door structure.

The object of the invention is to improve a vehicle door with such a basic structure in such a way that the equipment support fulfils its function without the need for any additional reinforcement, while at the same time optimizing the use of the space available in the door structure and that the door, in its entirety, be produced at lower cost.

~~This object is achieved according to the invention by a vehicle door which has the characteristics set out in Claim 1.~~

~~SUMMARY OF THE INVENTION~~  
The equipment support, comprising at least one region in the form of a double shell box structure, resistant to warping, consisting of two continuous walls which are spaced apart and parallel to the outer wall of the door, forms an element which is stable without the participation of an interior trim lining or other elements.

Furthermore, with the outer surface of the box structure which faces towards the outer wall of the door, extending a limited distance away from and parallel to the line of movement of the window glass which can be dropped down into the space between the outer wall of the door and the said surface of the box structure, the use of the restricted space in the door structure is optimized. It must be emphasized that, on all modern motor cars, the door side windows which can move are curved, at least cylindrically, in order to reduce the resistance to the air. The said line of movement is therefore usually curved. The described shape of the surface of the equipment support, facing towards the window pit or the outer skin of the door

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uses the said marginal condition to reinforce the surface without additional elements.

Openings may also be provided in the box structure for installing equipment such as loudspeakers or the like. Advantageously, all of these openings are made on that face of the equipment support which faces towards the inside of the vehicle, and they do not affect its inherent rigidity.

That surface of the region of the equipment support in the form of a box structure and facing towards the outer skin of the door bounds the so-called wet zone, which essentially consists of the window pit. Equipment (for example: the window lifter drive mechanism, the guide rails) generally has to be installed from this side. Appropriate fastening means may be provided on this outer side of the box structure. In each case, the number and size of the openings needed in the surface of the outer wall must be minimized. Thus, the closed wall of the box structure region constitutes a durable barrier against the ingress of dirt and moisture from the wet zone towards the inside of the box structure and inside of the vehicle.

The wall which faces towards the inside of the vehicle may be designed directly according to the stylistic ideas of the day, without having to account for the technical requirements for the mounting of equipment. Thus, using the equipment support according to the invention, the technical functions and the various decorative functions are entirely separate from one another, this being an enormous advantage as far as the freedom it gives in the design of the interior side of the door is concerned.

Depending on the manufacturing options, it is possible to produce the region of the equipment support that is in the form of a box structure in several parts, for example in two parts, each part forming one wall, or as a single element, for example produced by blow-moulding or pressing from a part-finished plastic

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product. The use of blow-moulding manufacturing techniques in the production of very complex shapes such as fuel tanks made out of cured plastic is known.

For multi-part embodiments the two shell or dish-shaped parts of the equipment support are preferably fixed together along the entire periphery of the two shells or, if one of the shells is smaller than the other, along the entire periphery of the smaller of the shells, for example by bonding or welding. Thus, the box structure of the equipment support acquires particularly high rigidity and resistance to warping.

*BRIEF DESCRIPTION OF THE DRAWINGS*

One embodiment of the invention will be described hereinafter in greater detail with the aid of the figures, which depict:

15 - Figure 1: an exploded view of a vehicle door according to the invention,

- Figure 2: a diagrammatic sectioned view of the box structure region of the equipment support, on the line II-II of Figure 1.

*DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS*

20 The door according to the invention comprises a conventional metal construction with a lower door structure 1 forming a well and a surround for a window 2, the surround being fixed to the door structure. The door structure has an outer wall 3, a lower wall 4 and lateral walls 5 and 6. The lower wall 4 and the lateral walls 5 and 6 may consist of separate rigid frame elements made of rectangular section pieces but may preferably also consist of pressed sheet metal. They comprise fixing flanges 7 and form a broad opening in which the equipment support is placed and screwed to the fixing flanges 7.

35 The equipment support depicted here in several parts, comprises a shaped piece 8, essentially in the shape of a shell and a shaped piece 12, also essentially in the form of a shell. The surface dimensions of the two shaped pieces 8 and 12 with shell-shaped regions and their geometrical configuration at the edges of their shell are tailored to suit each other, so that the shaped piece 12 can be

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fixed to the shaped piece 8 forming a box structure section with a closed edge right around the periphery of the said box structure. In the case of thermoplastic or metallic materials, the two shaped pieces are preferably fixed together along their edge by welding.

~~It may already be noted that the shaped piece 8 comprises two open hollows 9, 22 in the plane of separation of the two-part equipment support, at least one of the hollows forming part of the box structure that is to be formed. The hollows consist of the bottoms of dished regions and of lateral walls. The latter run transversely to the plane of separation of the equipment support. They essentially determine its volume and thus play an important part in its~~

~~mechanical strength~~

The shape of the box structure in the region of the largest hollow 9 will be discussed again in greater detail later with reference to Figure 2.

~~It must be noted that the shaped piece 8 may also have just one hollow. In this particular instance, the recessed areas between the two hollows 9 and 22 can be used as a space in which to mount certain equipment items in the wet zone, but is not required in all scenarios.~~

In the scenario depicted, the shaped piece 12 facing towards the inside of the vehicle does not extend over the entire surface of the shaped piece 8, but covers only about two thirds of its surface. This is, however, entirely sufficient in this scenario because all of the equipment items which exert mechanical forces on the shaped piece 8 are placed in this region of the shaped piece 8 which is covered by the shaped piece 12 and thus perfectly mechanically stable. The connection with the shaped piece 12 gives this region of the equipment support particularly good rigidity, this system forming a stable box structure.

The shaped piece 12 may, in theory, be designed and dimensioned from other points of view. Firstly, it is necessary, in this instance, to take account of the

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fact that the shaped piece 12 has to improve the rigidity of the shaped piece 8. At the same time, it is also necessary to take account of the fact that rather high tensile forces are transmitted to the shaped piece 12 when the door handle 14 is actuated, and this has to be taken into consideration when dimensioning and designing the shaped piece 12.

The two shaped pieces 8 and 12 may naturally be manufactured from any material whatsoever, as long as it has the necessary strength and resistance to deformation. In particular, they may be manufactured of pressed sheet metal or of an appropriate polymer, or, in particular, may also be made of glass-fibre-reinforced plastic, moulding being performed according to the known and customary methods.

The equipment items may be placed and arranged in and fixed to the shaped piece 8 in the known and customary way, and this is not depicted in the example described here. Essentially, the slideways for guiding the moving window glass in a vertical direction, the window glass itself, and the window lifter mechanism, are fixed to this shaped piece 8. This equipment is mounted on the shaped piece 8 during a separate assembly stage. The shaped piece 12 may already be fixed to the shaped piece 8 prior to the mounting of the equipment, but it is also possible for the two shaped pieces to be connected after the equipment has been mounted.

The door module prepared in this way, consisting of the equipment support, the window glass and all the equipment, is placed in the door structure at the time of final assembly of the vehicle or of the vehicle door, and is screwed to the fixing flanges 7.

A sealing barrier may be formed between the wet zone and the interior space of the vehicle by a seal fitted between the fixing flanges 7 and the periphery of the equipment support fixed thereto. The seal may, for example, be made of an extrudable sealing foam.

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*need to show*

⇒ The shaped piece 8 and the shaped piece 12 are fitted with push-fit or clip-fastening elements not depicted in detail here, which allow other elements to be attached quickly and simply to the interior face of the door. Thus, for example, a door handle component 14 may be placed in a corresponding recess 15, a loudspeaker 16 may be placed in an appropriate opening 17, and a cover grille 18 for the loudspeaker 16 may be placed in a corresponding hollow 19. A shaped piece 20, which consists of an appropriate foam material and is, for example, equipped with an arm rest surface 21, is arranged in the corresponding hollow 22 of the equipment support and affords impact protection. Finally, a shaped piece 24 is also arranged on the equipment support or on the fastening flange 7 of the door box structure and constitutes the window rest, and a shaped piece 26 is arranged near the bottom of the door to form a home for maps, a shaped piece 28 in the form of a moulding being inserted between these two shaped parts and constituting a lateral closure in the form of a frame element. Additional coatings of the shaped piece 12 are not needed, and those surfaces of the shaped piece 12 which are not covered by the aforementioned pieces are designed directly to be decorative surfaces.

*curved*

(The view in section on the line II-II of Figure 1 that is Figure 2 shows) that the window drops down inside the door structure along a curved line of movement F. This lies in the wet zone of the vehicle door. That wall of the equipment support which faces towards the outside of the door represents the closed end wall of the hollow 9 of the shaped part 8. The closed end of the hollow is parallel and as close as possible to the line of movement F and because its surface is curved is inherently very strong. Together with the side walls of the hollow 9, this thus constitutes a stable half box structure which may be closed by the shaped part 12. It will be understood that the size of the equipment support in proportion to

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the interior door space allows the maximum use to be made of this space.

5 The sectioned view also depicts a loudspeaker 16 and the grille 18 which covers it, both fixed in the shaped part 12. The closed end of the hollow in the shaped part 8 also constitutes a reliable barrier against the ingress of dirt and moisture from the wet zone of the door. It is possible to avoid producing an additional seal in the sensitive areas such as the sites of loudspeakers.

10 The curvature of the closed end of the hollow also has the advantage of comprising the guide rails for the drop glass, these being closely fixed, that is to say in direct contact with the closed end of the hollow. These rails can therefore be fixed to the equipment support without spacing pieces or other elements, at a lower cost and with the best possible support.

20 When the equipment support is made as a single piece, the use of the space may be further enhanced because the separating or fixing flange of the two parts 8 and 12 visible in Figure 2 can be omitted or replaced by projecting fixing means of limited extent.

25 The hollow 22 intended for the insertion of the shaped piece 20 which affords impact protection is as deep as the hollow 9. It is thus possible to fix a particularly thick impact absorber, which increases the passive safety of the vehicle door. It is possible to dispense with a separate trim lining if the shaped part 30 20 is equipped with a decorative material. In this case, the equipment support is not made as two shells in this region.